

## Gravity's Pull - Investigating the Effects of Gravity

Teacher Notes and Teacher's Answer Key available upon request.

**Activity Extension:** "How many Fig Newtons® equal one newton?", a.k.a., "Newtons® in a newton."

### Do THIS...

- Visit the official Nabisco® Fig Newtons® website:  
<http://www.nabiscoworld.com/newtons/>
- Search for "Nutrition Facts":  
Varieties/NEWTONS - COOKIES - FIG NEWTONS 16oz  
Nutrition Info



Nutrition Facts:

Serving Size 31 g

Servings per Container 15

### THINK ABOUT THIS...

Problem: How Many Fig Newtons® equal one newton?

Solution: Answer the following questions. Show your work, i.e., write the formula for the problem, substitute numbers and units into the formula, and circle your answer.

1. If there are 30 cookies per (16oz) package, then how many cookies are in each serving?

$$30 \text{ cookies (per package)} / 15 \text{ servings} = 2 \text{ cookies per serving}$$

2. Given the serving size in grams (g), calculate the mass of a single cookie, expressed in kilograms (kg).

$$31 \text{ g (serving size)} / 2 \text{ (cookies per serving)} = 15.5 \text{ g per cookie}$$
$$15.5 \text{ g} = 0.015 \text{ kg} \rightarrow \text{mass of a single cookie}$$

3. What is the weight of a single cookie, expressed in newtons (N)?  
**Point of Focus:** The weight of an object in newtons (N) is approximately 10 times its mass in kilograms (kg).

$0.015 \text{ kg} \times 9.8 \text{ m/s}^2 = 0.147 \text{ kg}\cdot\text{m/s}^2$  or  $0.147 \text{ N}$  → weight of a single cookie

**Note:** The focal point of Part 1 of lab activity is weight (N) is ~10x greater than mass (kg) or vice versa, i.e., mass (kg) is ~1/10 weight (N); see RSLG p. S27. For example,  $0.147 \text{ N} = 0.147 \text{ kg}\cdot\text{m/s}^2$ ;  $0.147 \text{ kg}\cdot\text{m/s}^2 / 9.8 \text{ m/s}^2 = 0.015 \text{ kg}$

4. One newton (1 N) equals the total weight of how many cookies?  
**Point of Focus:** What is the size of a newton relative to a popular cookie?

$1 \text{ N} / 0.147 \text{ N/cookie} = \sim 6.8 \text{ cookies}$  → the answer!

### FOR FURTHER THOUGHT...

- A. Convert your weight from pounds (lb) to newtons (N).

Your Weight: \_\_\_\_\_ lb

Conversion Factor:  $1 \text{ kg} = 2.2 \text{ lb}$

Dimensional Analysis:  $\frac{? \text{ lb}}{1} \cdot \frac{1 \text{ kg}}{2.2 \text{ lb}} = \text{_____ kg}; \text{_____ N}$

**Point of Focus:** The weight of an object in newtons (N) is approximately 10 times its mass in kilograms (kg).

Answers will vary. For example, a 150-lb boy has a mass of ~68.2 kg and a weight of 668.36 N.

- B. Determine your weight (in pounds & newtons) on the Moon.  
**(Note:** Your weight on the Moon is ~1/6 your weight on Earth.)  
**Point of Focus:** Three variables determine the gravitational force of attraction between two objects: The product of the mass of the two objects divided by the distance between the objects—if one or more of the variables are changed, then the weight of an object will be different. Discover the interrelationship among these variables empirically by visiting the [Gravitational Force Calculator](http://www.wsanford.com/~wsanford/gr8ps/04_red/02_gravitys_pull/extras/gravity-calculator.html):  
[http://www.wsanford.com/~wsanford/gr8ps/04\\_red/02\\_gravitys\\_pull/extras/gravity-calculator.html](http://www.wsanford.com/~wsanford/gr8ps/04_red/02_gravitys_pull/extras/gravity-calculator.html)

\_\_\_\_\_ lb; \_\_\_\_\_ N

Answers will vary. For example, 150-lb boy has a weight on the Moon of 25 lb or ~111.2 N.